

## PICC or central venous catheter?

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The following question was answered by a systematic review of the literature:

Should peripherally inserted central catheters (PICC) versus central venous catheters (CVC) be used in in-hospital patients with intravenous therapy?

**Study population:** inpatients requiring intravenous therapy

**Comparison:** PICC versus CVC

**Outcome:** pneumothorax, difficult insertion, catheter-related bloodstream infection, deep venous thrombosis, catheter discontinuation because of complication, phlebitis

### Methods

Data sources

Publications were retrieved by a search of Medline and the Cochrane Library up to 17 November 2008. The search strategy in Cochrane was: peripherally inserted central catheters\* OR PICC. To identify randomised controlled trials in Medline the following search strategy was used: ((randomized controlled trial [pt] OR controlled clinical trial [pt] OR randomized controlled trials [mh] OR random allocation [mh] OR double-blind method [mh] OR single-blind method [mh] OR clinical trial [pt] OR clinical trials [mh] OR "clinical trial" [tw] OR ((singl\* [tw] OR doubl\* [tw] OR trebl\* [tw] OR tripl\* [tw]) AND (mask\* [tw] OR blind\* [tw]))) OR "latin square" [tw] OR placebos [mh] OR placebo\* [tw] OR random\* [tw] OR research design [mh:noexp] OR comparative study [mh] OR evaluation studies [mh] OR follow-up studies [mh] OR prospective studies [mh] OR cross-over studies [mh] OR control\* [tw] OR prospectiv\* [tw] OR volunteer\* [tw]) NOT (animal [mh] NOT human [mh])) AND (peripherally inserted central catheter\* OR PICC). Additionally, all reference lists of identified trials were examined.

Selection criteria

All randomised and quasi-randomised trials comparing PICCs versus CVCs and pneumothorax, difficult insertion, catheter-related bloodstream infection, deep venous thrombosis, catheter discontinuation because of complication or phlebitis as the outcome measures were included.

## Review methods

Data were extracted by two reviewers independently and compared. Disagreements were resolved by discussion. Data from the original publications were used to calculate the relative risk of dichotomous outcomes. Data for similar outcomes were combined in the analysis where appropriate, using a random-effects model. The quality of evidence per outcome was assessed by using the Grade system <sup>1</sup>.

## Results

One hundred and fifty nine potentially relevant studies were initially identified by our search. By judgment of titles and abstracts, one parallel-group randomised controlled trial fulfilled the selection criteria and was included in the review <sup>2</sup>.

## Validity assessment

See Table 1

## Study population, interventions and outcome definitions

See Table 2

## Grade Evidence profil

See table 3

## Summary estimates of associations between treatment and control group

See Figure 1 and 2

**Table 1** Data on quality assessment

	Concealment of allocation	Description of dropouts	Analysis by intention-to-treat	Stopping trial early to benefit	Selective reporting of events
Cowl 2000	Adequate	Inadequate (NR)	Unclear	No	No

Blinding of outcome assessment not feasible

**Table 2** Study populations, interventions and outcome definitions

	Setting	Treatment (T) and control group (C)	Uses	Median catheter days (range)	End of study protocol	Outcomes n / N
Cowl 2000 <sup>1</sup>	Adult inpatients with a visible basilic, median cubital or cephalic vein	T: PICC C: CVC (subclavian)	TPN <sup>2</sup>	T: 9.6 (1-36) C: 10.8 (2-27)	Catheter removal because of no longer required or development of a complication	<p>Difficult insertion attempts Defined as &gt;2 and &lt;5 needle sticks T: 11 / 51; C: 5 / 51</p> <p>Complications requiring catheter removal<sup>3</sup> T: 27 / 51; C: 35 / 51</p> <p>Clinically-evident thrombophlebitis T: 8 / 51; C: 1 / 51</p> <p>Upper extremity deep venous thrombosis Defined as moderate or severe clinically-evident thrombophlebitis with a positive venous Doppler of the affected area (clot formation) T: 5 / 6; C: 0 / 1</p> <p>Pneumothorax T: 0 / 51; C: 2 / 51</p>

<sup>1</sup> Notes: experienced staff had difficulty with insertion of PICC

<sup>2</sup> Total parenteral nutrition

<sup>3</sup> Thrombophlebitis, malposition, pneumothorax, line occlusion, catheter infection, dislodged catheter, catheter failure / leak or aborted insertion attempt

**Table 3** Grade evidence profil'

Quality assessment							Summary of findings				Quality	Importance
No of studies	Design	Limitations	Inconsistency	Indirectness	Imprecision	Other considerations	No of patients		Effect			
							peripherally inserted central catheters	central venous catheters	Relative (95% CI)	Absolute		
<b>Upper extremity deep venous thrombosis (follow-up median 10 days; clinically evident thrombophlebitis and clot formation on Doppler)</b>												
1	randomised trial	no serious limitations	serious <sup>1</sup>	serious <sup>2</sup>	serious <sup>3</sup>	none	5/6 (83.3%)	0/1 (0%)	RR 3.14 (0.28 to 35.75) <sup>4</sup>	0 more per 1000 (from 0 fewer to 0 more)	+OOO VERY LOW	CRITICAL
<b>Pneumothorax (follow-up median 10 days)</b>												
1	randomised trial	no serious limitations	serious <sup>1</sup>	no serious indirectness	serious <sup>3</sup>	none	0/51 (0%)	2/51 (3.9%)	RR 0.20 (0.01 to 4.07) <sup>4</sup>	31 fewer per 1000 (from 39 fewer to 120 more)	++OO LOW	CRITICAL
<b>Clinically evident thrombophlebitis (follow-up median 10 days; artikel opgevraagd)</b>												
1	randomised trial	no serious limitations	serious <sup>1</sup>	no serious indirectness	serious <sup>3</sup>	none	8/51 (15.7%)	1/51 (2%)	RR 8.00 (1.04 to 61.67)	140 more per 1000 (from 1 more to 1000 more)	++OO LOW	IMPORTANT
<b>Complications requiring catheter removal (follow-up median 10 days)</b>												
1	randomised trial	no serious limitations	serious <sup>1</sup>	no serious indirectness	serious <sup>3</sup>	none	27/51 (52.9%)	35/51 (50%)	RR 0.77 (0.56 to 1.06)	115 fewer per 1,000	++OO LOW	IMPORTANT
<b>Difficult insertion (follow-up median 10 days; &gt;2 and )</b>												
1	randomised trial	no serious limitations	serious <sup>1</sup>	no serious indirectness	serious <sup>3</sup>	none	11/51 (21.6%)	5/51 (0%)	RR 2.20 (0.82 to	0 more per 1,000	++OO LOW	CRITICAL

									5.88)			
<b>Catheter-related bloodstream infection - not reported</b>												
0												CRITICAL

<sup>1</sup> Single study

<sup>2</sup> Deep venous thrombosis was diagnosed by performing venous Doppler studies in patients with moderate or severe phlebitis. However, central venous catheter-associated deep venous thrombosis does clinically not present as phlebitis. So, the definition used by the authors, i.e. "clinically evident thrombophlebitis plus clot formation on Doppler", was clinically not relevant.

<sup>3</sup> Study with small sample size and wide confidence intervals

<sup>4</sup> Calculated by adding 0.5 in the nominator and denominator

GRADE Working Group grades of evidence

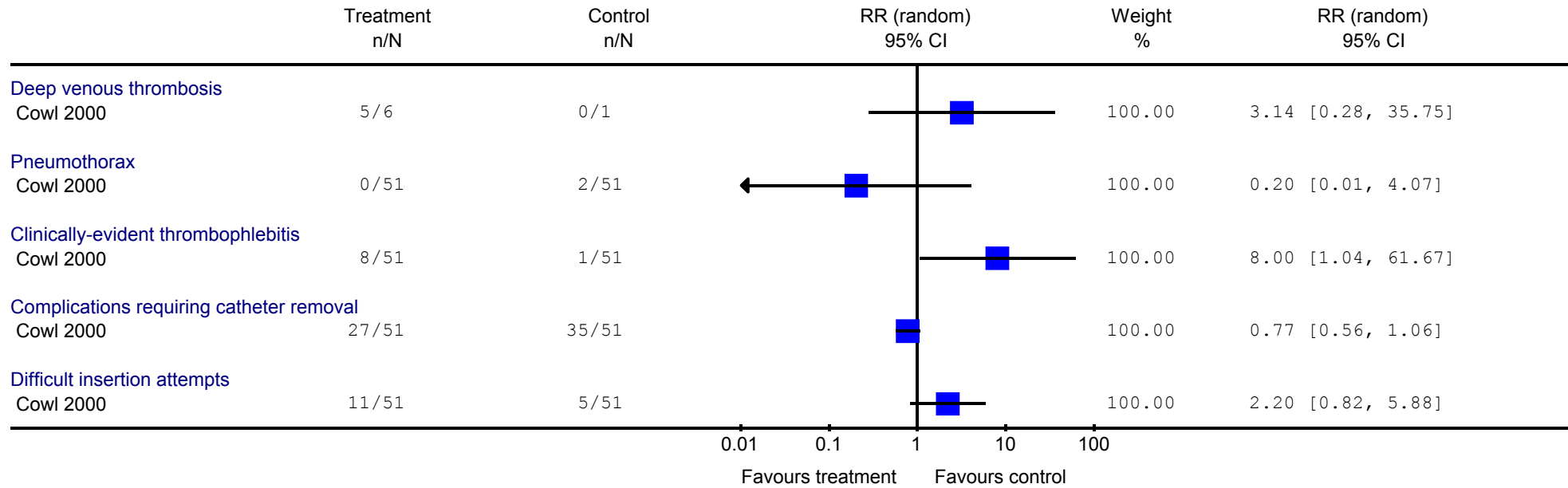
**High quality:** Further research is very unlikely to change our confidence in the estimate of effect.

**Moderate quality:** Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

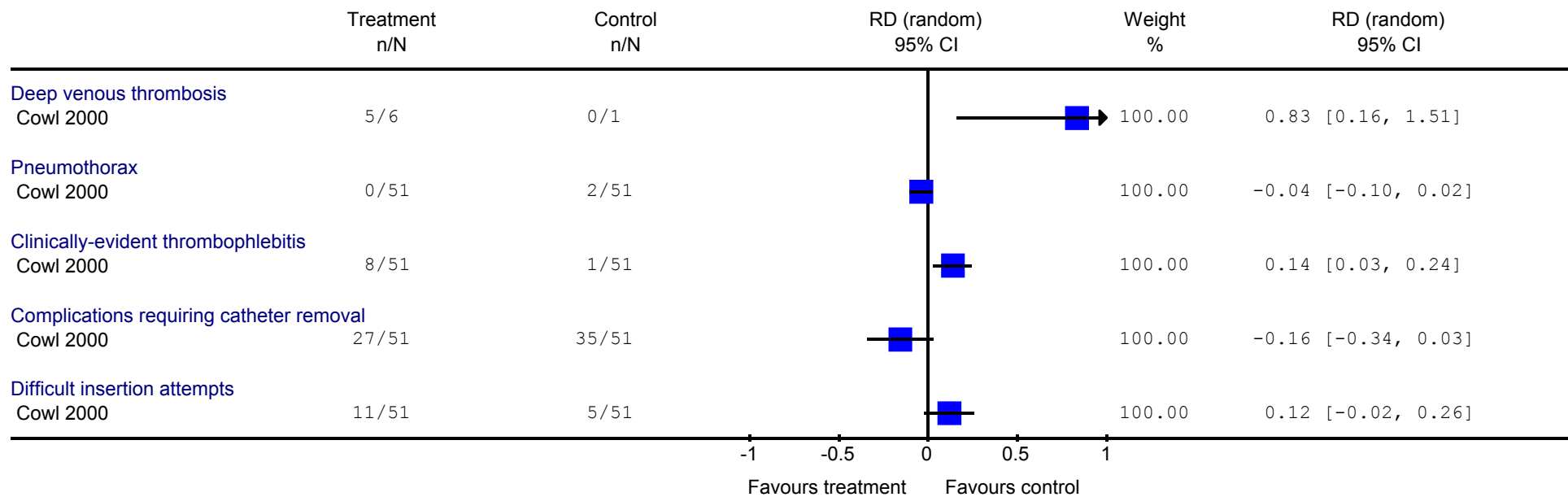
**Low quality:** Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

**Very low quality:** We are very uncertain about the estimate.

**Figure 1** Summary estimates of association between PICCs and central venous catheters expressed as relative risk (RR) and 95% confidence interval (CI).



**Figure 2** Summary estimates of association between PICCs and central venous catheters expressed as risk difference (RD) and 95% confidence interval (CI).



## Comments

Deep venous thrombosis was diagnosed by performing venous Doppler studies in patients with moderate or severe phlebitis. However, central venous catheter-associated deep venous thrombosis does clinically not present as phlebitis. So, the definition used by the authors, i.e. 'clinically evident thrombophlebitis plus clot formation on Doppler', is clinically not relevant.

Nowadays, PICCS are inserted in the upper arm. The authors did not report whether the PICCs were inserted in the forearm or the upper arm.

## Conclusion

The evidence available whether PICCs are superior to CVCs in patients requiring intravenous therapy to prevent pneumothorax, difficult insertion, catheter-related bloodstream infection, deep venous thrombosis, catheter discontinuation because of complication and phlebitis, is not sufficient as a basis for determining practice. A single trial investigated this issue. Catheter-related bloodstream infection was not reported. For all other outcomes the quality of evidence was low to very low. Not any finding was statistically significant.

## Reference List

1. Atkins D, Best D, Briss PA *et al.* Grading quality of evidence and strength of recommendations. *BMJ* 2004; **328**: 1490.
2. Cowl CT, Weinstock JV, Al Jurf A, Ephgrave K, Murray JA, Dillon K. Complications and cost associated with parenteral nutrition delivered to hospitalized patients through either subclavian or peripherally-inserted central catheters. *Clin Nutr* 2000; **19**: 237-243.